1 Declaration

Site Name and Location

This Record of Decision (ROD) presents the Selected Remedy for Operable Unit (OU) No. 23, Site 49, located at the Marine Corps Installations East-Marine Corps Base Camp Lejeune (MCIEAST–MCB CAMLEJ) in Onslow County, North Carolina. MCIEAST–MCB CAMLEJ was placed on the United States Environmental Protection Agency (USEPA) National Priorities List (NPL) effective November 4, 1989 (USEPA Identification [ID]: NC6170022580). The remedy set forth in this ROD was selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

This decision is based on information contained in the Administrative Record file for this site. Information not specifically summarized in this ROD or its References, but contained in the Administrative Record has been considered and is relevant to the selection of the remedy at OU No. 23. Thus, the ROD is based on and relies upon the entire Administrative Record file in making the decision. As a result of the NPL listing, and pursuant to CERCLA, the USEPA Region 4, North Carolina Department of Environment and Natural Resources (NCDENR), the United States Department of the Navy (Navy), and the United States Marine Corps (USMC) entered into a Federal Facilities Agreement (FFA) for MCIEAST-MCB CAMLEJ in 1991. The primary purpose of the FFA is to ensure that the environmental impacts associated with past and present activities at the Base are thoroughly investigated. The Installation Restoration Program (IRP) is responsible for ensuring that appropriate CERCLA response alternatives are developed and implemented as necessary to protect public health, welfare, and the environment. No enforcement activities have been recorded at Site 49.

Statement of Basis and Purpose

The Navy is the lead agency and provides funding for site cleanups at MCIEAST-MCB CAMLEJ. The remedy set forth in this ROD has been selected by the Navy, USMC, and USEPA. NCDENR, the support regulatory agency, actively participated throughout the investigation process and, hence, has reviewed this ROD and the materials on which it is based and concurs with this Selected Remedy.

Scope and Role of Response Action

OU No. 23 is one of 25 OUs in the IRP at MCIEAST-MCB CAMLEJ. Information on the status of all the OUs and sites at MCIEAST-MCB CAMLEJ can be found in the current version of the Site Management Plan, available as part of the Administrative Record. OU No. 23 is solely composed of Site 49. This ROD presents the final remedial action for Site 49 and OU No. 23.

1.1 Selected Remedy

Assessment of the Site

Previous investigations have identified the presence of volatile organic compounds (VOCs) in groundwater at Site 49 at concentrations that pose a potential threat to human health under future residential use scenarios. The Selected Remedy for Site 49 is monitored natural attenuation (MNA) and land use controls (LUCs) to prohibit aquifer use and mitigate exposure to vapor intrusion. The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

Statutory Determinations

The Selected Remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost-effective, and uses permanent solutions to the maximum extent practicable. The remedy does not satisfy the statutory preference for treatment as a principal element because no source materials constituting principal threats are present, trends over time indicate that MNA will be effective within a reasonable timeframe, groundwater is not used for drinking water, and LUCs will prevent exposure until concentrations allow for unlimited use and unrestricted exposure (UU/UE). Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for UU/UE, a statutory review will be conducted within five years after initiation of the remedial action to ensure that the remedy is, or will be, protective of human health and the environment.

1.2 Data Certification Checklist

The following information is included in the Decision Summary section of this ROD. Additional information can be found in the Administrative Record[1] file for MCIEAST-MCB CAMLEJ, Site 49.

- Chemicals of concern (COCs) and their respective concentrations (Section 2.4 and Table 2)
- Baseline risk represented by the COCs (Section 2.6)
- Cleanup levels established for COCs and the basis for these levels (Section 2.8 and Table 6)
- How source materials constituting principal threats are addressed (Section 2.7)
- Current and reasonably anticipated future land use assumptions and current and potential future beneficial uses of groundwater used in the baseline risk assessment and ROD (Section 2.5 and Section 2.6)
- Potential land and groundwater use that will be available at the site as a result of the Selected Remedy (Section 2.10.3 and Table 9)
- Estimated capital, annual operations and maintenance (O&M), and total present-worth costs, discount rate, and the number of years over which the remedy cost estimates are projected (Section 2.9 and Table 7)
- Key factor(s) that led to selecting the remedy (describing how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision) (Section 2.10.1)

If contamination posing an unacceptable risk to human health or the environment is discovered after execution of this ROD, the Navy will undertake all necessary actions to ensure continued protection of human health and the environment.

[1] **Bold blue text** identifies detailed site information available in the Administrative Record and listed in the References Table.

1.3 Authorizing Signatures

This ROD presents the Selected Remedy at Site 49, OU No. 23, at MCIEAST-MCB CAMLEJ, located in Onslow County, North Carolina.

RF Castellvi

3 MAR 2014

R. F. CASTELLVI
Brigadier General, U.S. Marine Corps
Commanding General
Marine Corps Installations East-Marine Corps Base Camp Lejeune

Date

4/24/14

Franklin E. Hill
Director, Superfund Division
United States Environmental Protection Agency, Region 4

Date

With concurrence from:

3-20-14

Dexter R. Matthews
Director, Division of Waste Management
North Carolina Department of Environment and Natural Resources

Date

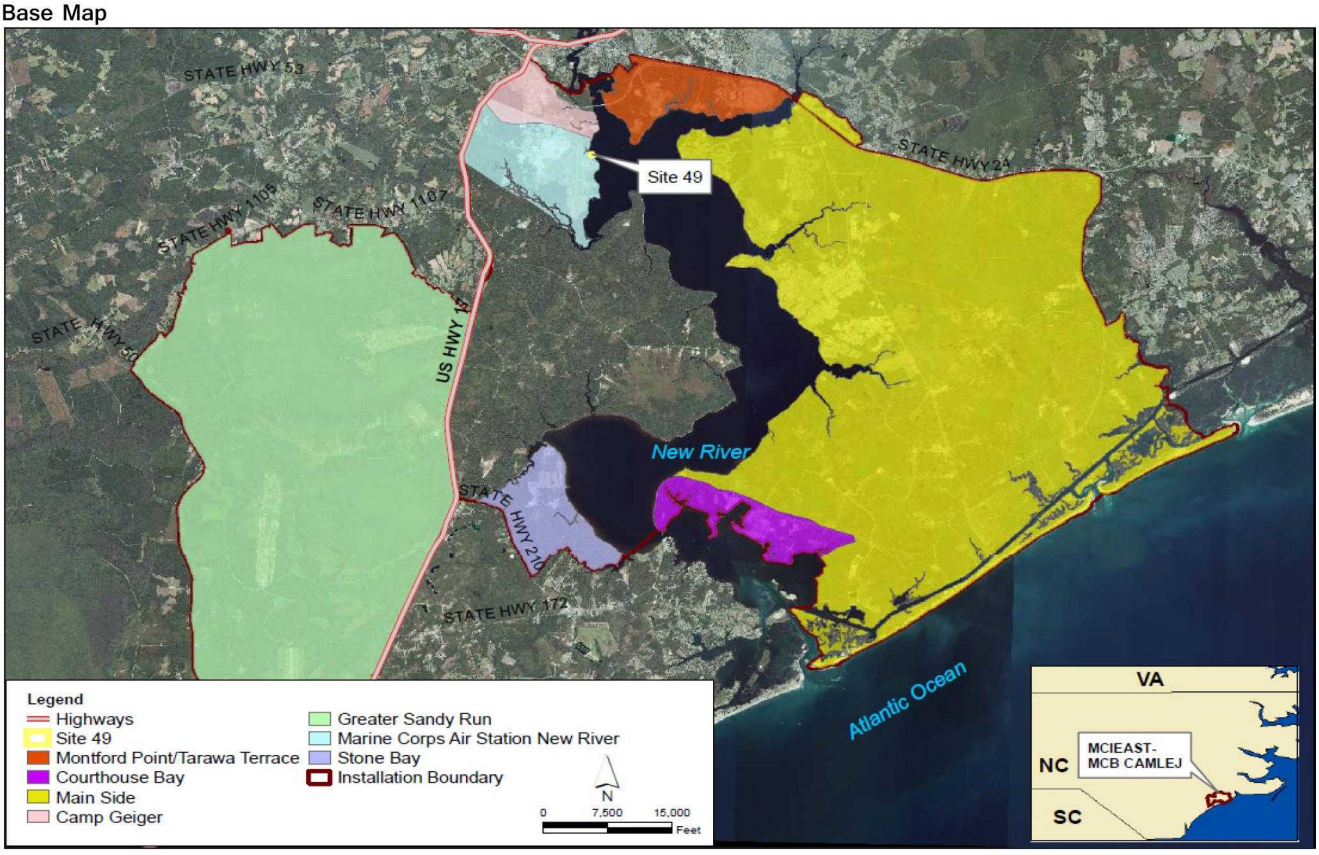
2 Decision Summary

2.1 Site Description and History

MCIEAST-MCB CAMLEJ is a 156,000-acre facility located in Onslow County, North Carolina, adjacent to the southern side of the City of Jacksonville. The mission of MCIEAST-MCB CAMLEJ is to maintain combat-ready units for expeditionary deployment. The Base provides housing, training facilities, and logistical support for Fleet Marine Force Units and other assigned units.

Site 49 is located aboard Marine Corps Air Station (MCAS) New River, in the northwest portion of MCIEAST-MCB CAMLEJ (**Figure 1**). Site 49 was first identified in the early 1980s as the MCAS Suspected Minor Dump, where possible disposal of paint and potentially hazardous substances may have occurred in a 2-acre area (**Figure 2**). Based on the results of environmental investigations conducted to-date (Section 2.3), the site boundary was updated to reflect the extent of contamination and covers approximately 0.95 acres located on the south bank of the New River. The site is covered with a small maintained grassy area in the northern portion and a forested wetland bisected by a drainage feature in the southern portion. Building AS810, primarily used for storage, is located immediately northwest of the site. A review of historical aerial imagery indicates that Building AS810 has been in use since the early 1950s.

FIGURE 1
Base Map



2.2 Site Characteristics

Site 49 is relatively flat, with elevations ranging from 2 to 6 feet above mean sea level (msl). The ground surface slopes gently to the New River to the northeast and a local drainage feature to the southeast. The northern portion of Site 49 is maintained grassy area. The southern portion of Site 49 consists of a forested jurisdictional wetland bisected by a drainage feature. A portion of surface water runoff from MCAS New River flows to the New River through a series of drainage channels that converge through the drainage feature (**Figure 2**).

The remnants of a former structure are situated adjacent to the southwest corner of Building AS810, and consist of a raised concrete pad that contains a central floor drain and several circular holes located along the side of the pad closest to Building AS810. A terra cotta pipe was observed ending in the New River near the southeast portion of the site, appearing to be in line with the former structure. The drain pipe appears to terminate in the wooded area approximately 60 feet inland from the bank of the New River. MCIEAST-MCB CAMLEJ does not have historical documentation regarding the use of the concrete pad, drains, or terra cotta pipe.

Groundwater investigations completed at Site 49 have focused on the surficial aquifer and underlying Castle Hayne aquifer. For the purposes of the ROD, the aquifers have been designated as two zones corresponding to the following depths: surficial (water table to approximately 20 feet below ground surface [bgs]) and upper Castle Hayne aquifer (20 to 45 feet bgs).

Surficial deposits observed at Site 49 are part of the undifferentiated formation, which when saturated, compose the surficial aquifer. From ground surface, a thin silty sand layer (0 foot to 3 feet thick) overlies a fine-grained sandy clay and clay deposit that extends to approximately 15 feet bgs. Isolated lenses of sand, woody debris, and brick were encountered within this unit near the New River.

Beneath the sand, silty sand, sandy clay, and clay of the undifferentiated formation lies the River Bend formation, which consists of silty sand and weakly cemented sandy limestone. The fossilized shells observed in this limestone are an identifying characteristic of the River Bend formation. This unit corresponds to the upper Castle Hayne aquifer, and was encountered to the maximum depth of investigation (45 feet bgs).

2.3 Previous Investigations

A brief summary of the previous investigations conducted at Site 49 is presented in **Table 1**. **Figure 2** presents all the surface soil, subsurface soil, groundwater, pore water, surface water, and sediment sample locations from previous investigations. Respective investigations at Site 49 are a part of the Administrative Record and can be referenced for further details.

FIGURE 2
Sample Locations

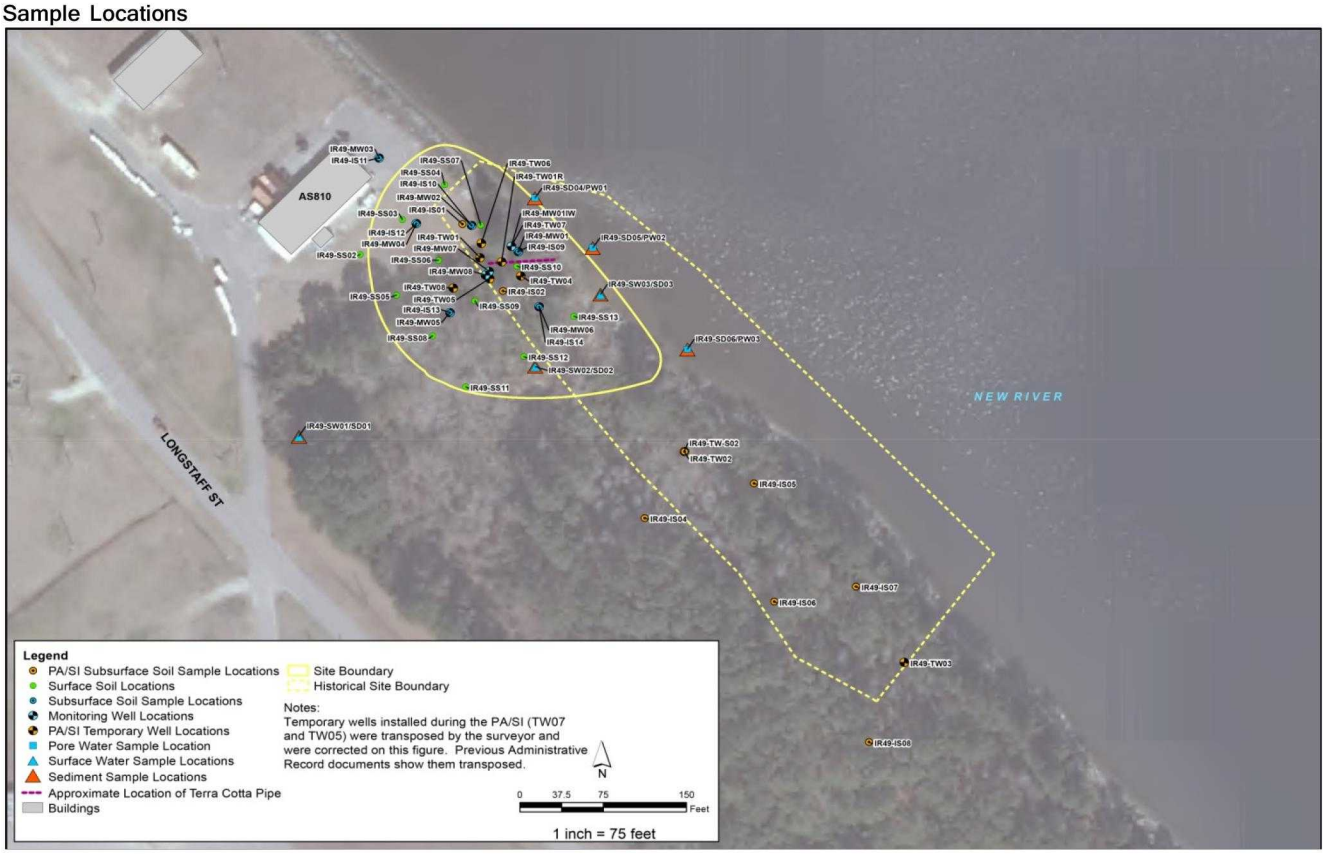


TABLE 1
Previous Investigations and Actions

Previous Investigation/Action*	Administrative Record Number	Dates	Activities and Findings
Initial Assessment Study (IAS), Water and Air Research, Inc, April 1983	001511	1983	Site 49 was identified as the **MCAS Suspected Minor Dump**. Site 49 was described as approximately 800 ft of shoreline along the New River where possible waste disposal that included paint, paint-related waste, and potentially hazardous substances may have occurred (see Historical Site Boundary depicted on **Figure 2**). The timeframe of the disposal activities was not specified in the report, and Site 49 was not recommended for further investigation because of the small quantity of waste reported.
Preliminary Assessment/Site Inspection (PA/SI), CH2M HILL, March 2011	004681	2009-2011	A PA/SI was conducted to confirm the no further action (NFA) recommendation in the IAS. The PA/SI was conducted in two phases. In July 2009, eight subsurface soil and three groundwater samples were collected and analyzed for semivolatile organic compounds (SVOCs), VOCs, and metals. Based on the results, six additional groundwater samples were collected in February 2010 and analyzed for VOCs (**Figure 2**). The PA/SI concluded that **potential human health and ecological risks** were present due to potential exposure to **chlorinated VOCs** in groundwater. Based upon the potential risks identified by the PA/SI, completion of a Remedial Investigation was recommended and the site boundary was reduced to encompass the extent of VOC contamination (see Site Boundary depicted on **Figure 2**).
Remedial Investigation/Feasibility Study (RI/FS), CH2M HILL, August 2012	005498	2011-2012	Surface soil, subsurface soil, groundwater, pore water, surface water, and sediment samples were collected to further define the **nature and extent of VOC contamination** and assess potential risks to human health and the environment (**Figure 2**). Sample locations were biased adjacent to and downstream from the building and terra cotta pipe. Chlorinated VOCs were detected at concentrations exceeding screening criteria at isolated soil, pore water, and groundwater locations. The RI concluded that the horizontal and vertical extents of VOCs were adequately defined and potential isolated sources were likely from historical dumping and/or associated from historical use of the terra cotta drain pipe. Based on the analytical results, no unacceptable human health risks associated with surface soil, subsurface soil, pore water, surface water, or sediment were identified and no significant risks to ecological receptors were identified from exposure to site media. However, potential unacceptable risks were identified to future residents from exposure to VOCs in groundwater, if used as a potable water supply, and from vapor intrusion if buildings are constructed within 100 feet of impacted groundwater. Based on the human health risks identified, an FS was conducted to identify the Remedial Action Objectives (RAOs) for groundwater and potential treatment technologies to satisfy these RAOs. The following **remedial alternatives** were assessed in the FS: (1) No action, (2) MNA and LUCs, (3) Air Sparging (AS) with MNA and LUCs, and (4) enhanced in situ bioremediation (EISB) with MNA and LUCs
Additional Groundwater Sampling and Results Technical Memorandum, CH2M HILL, January 2013	005539	2013	An additional round of groundwater analytical data from monitoring well IR49-MW01 was collected to further assess trends of groundwater data over time. Concentrations of VOCs continue to reduce over time and trend analysis indicates that the remedial time frame for MNA will be reduced from what was presented in the RI/FS.

*Documents listed are available in the Administrative Record and provide detailed information to support remedy selection at Site 49.

2.4 Nature and Extent / Fate and Transport of Contamination

Groundwater impacts are limited to VOCs in the surficial aquifer in the vicinity of monitoring well IR49-MW01. The COCs in groundwater at Site 49 that exceed the **North Carolina Groundwater Quality Standards (NCGWQS)** include 1,1,2,2-tetrachloroethane (1,1,2,2-PCA), 1,2,-trichloroethane (1,1,2-TCA), 1,2-dichloroethane (1,2-DCA), benzene, cis-1,2-dichloroethene (cis-1,2-DCE), tetrachloroethene (PCE), trichloroethene (TCE), trans-1,2-DCE, vinyl chloride (VC). The exceedances are isolated in the vicinity of IR49-MW01 and have been defined laterally and vertically. **Figure 3** illustrates the concentrations of VOCs in groundwater based on the results of the PA/SI and RI/FS and **Table 2** provides a summary of the maximum concentrations. Surface water and pore water samples were collected and evaluated to determine potential impacts to the New River. Although VOCs, were detected in surface water and pore water, the COCs in groundwater were not detected in surface water at concentrations above North Carolina Surface Water Quality Standards (NCSWQS).

Fate and Transport of Contamination

The primary contaminant migration pathway is through groundwater flow in the surficial aquifer. Vertical migration of COCs detected in the surficial aquifer to the upper Castle Hayne aquifer is not occurring based on the lack of detections in the upper Castle Hayne, low concentrations of COCs in the surficial aquifer, and upward vertical gradients measured between the two aquifer zones. Thus, horizontal groundwater migration is the primary contaminant transportation pathway. Low levels of VOCs were detected in the downgradient pore water, indicating that groundwater is discharging into the New River. **Figure 4** presents the conceptual site model (CSM).

FIGURE 3
Groundwater Plume Map

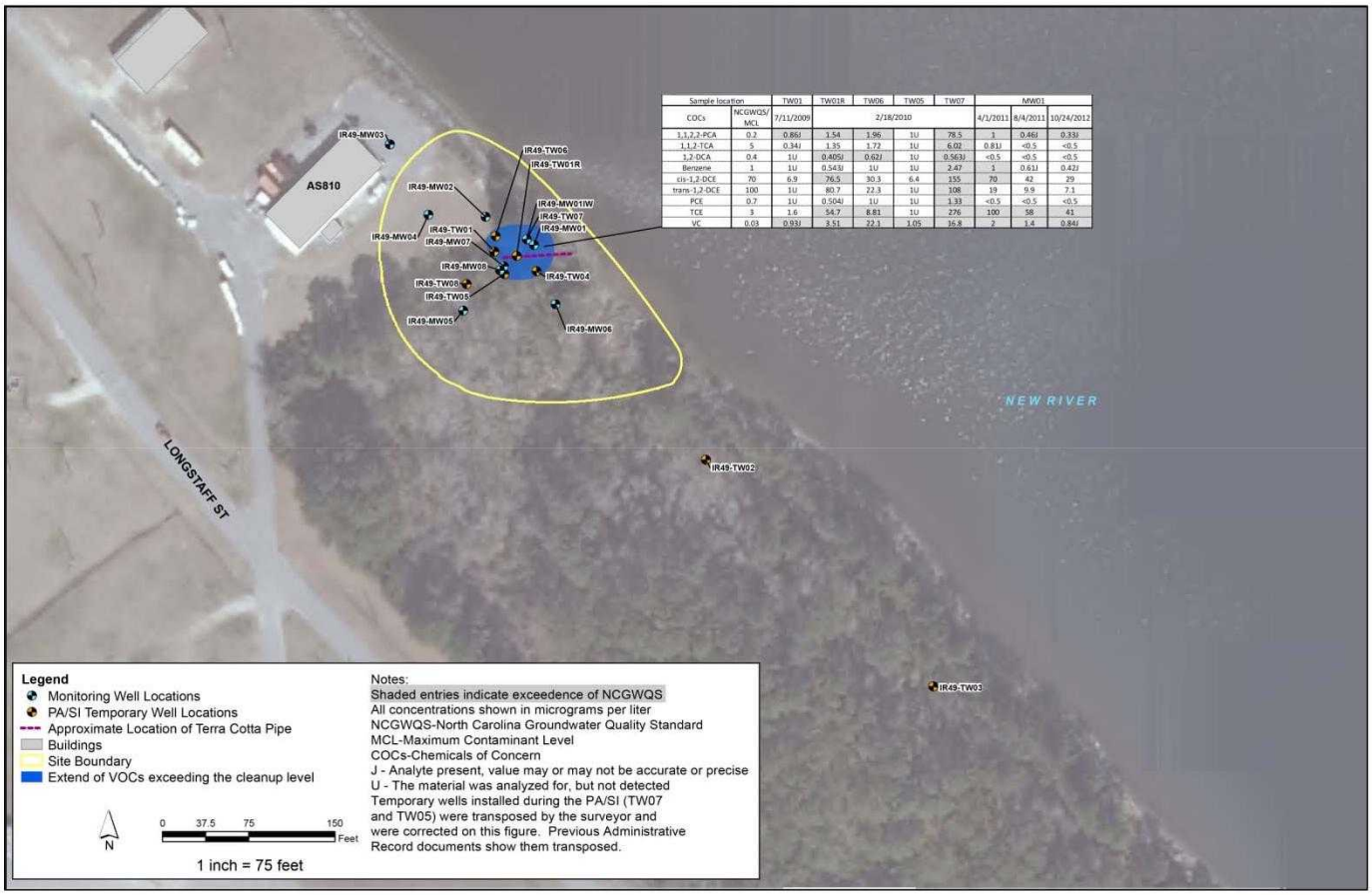


FIGURE 4
Conceptual Site Model

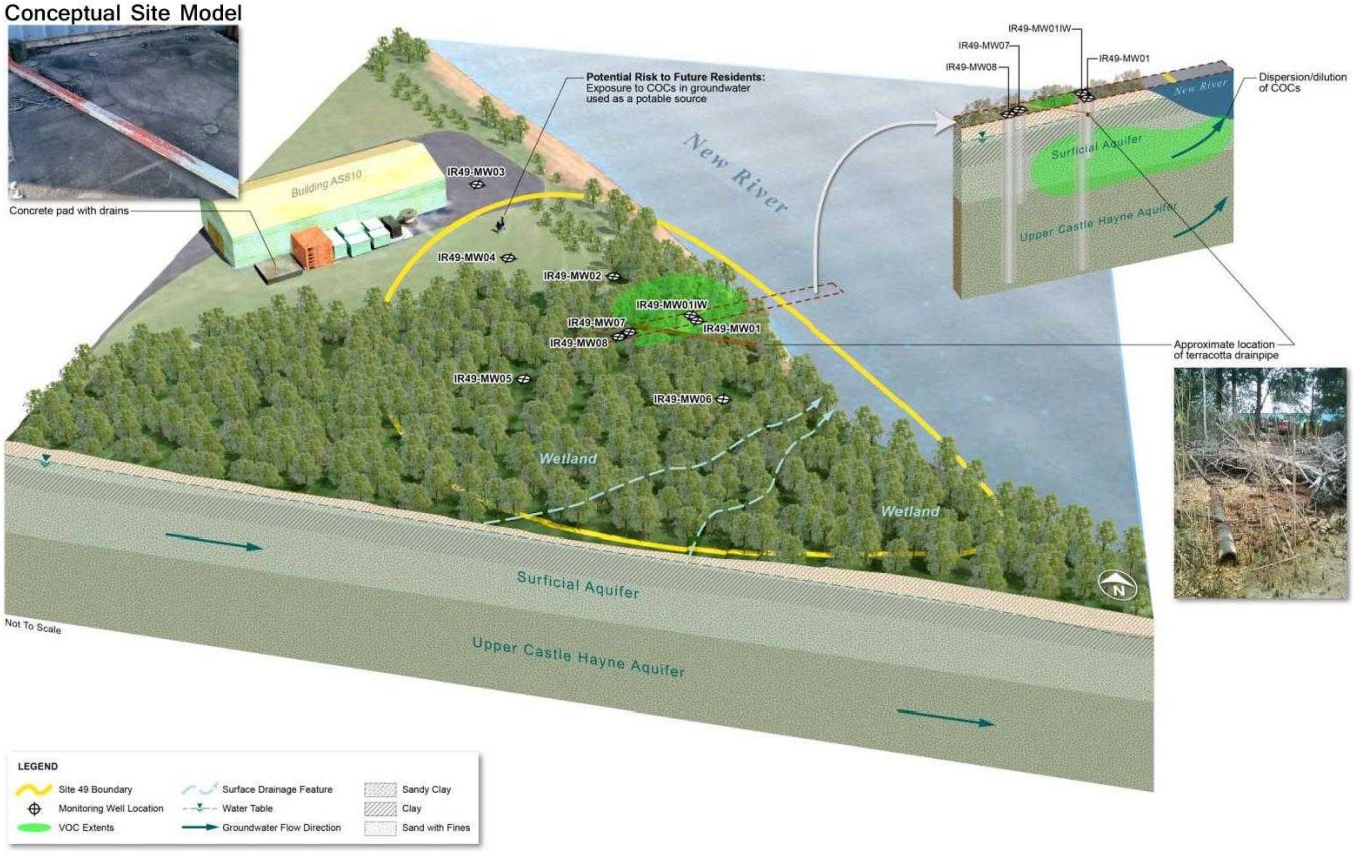


TABLE 2
Maximum Concentration of COCs

COCs	Maximum Concentration (µg/L)	NCGWQS/MCL* (µg/L)
1,1,2,2-PCA	78.5	0.2
1,1,2-TCA	6.02	5
1,2-DCA	0.62J	0.4
Benzene	2.47	1
cis-1,2-DCE	155	70
PCE	1.33	0.7
TCE	276	3
trans-1,2-DCE	108	100
VC	22.1	0.03

Note:
µg/L – micrograms per liter
*NCGWQS or MCL, whichever is more conservative

Monitored Natural Attenuation

Conditions in the surficial aquifer are generally unfavorable for biological degradation for COCs based on suboptimal natural attenuation (NA) indicator parameters (**Table 3**). However, groundwater analytical data collected from the site over a 17 month period (April 2011 to October 2012) exhibited a decreasing trend in COC concentrations. Specifically, concentrations of parent and degradation products in groundwater collected from monitoring well IR49-MW01 decreased by approximately 58 percent to 69 percent with no generation of additional degradation products. This parallel decline in COC concentrations suggests that physical degradation of VOCs is the primary mechanism for NA and includes dilution and adsorption. The New River is located downgradient of the eastern boundary of Site 49 and is the ultimate receptor for groundwater discharge from the site. Dissolved concentrations of the VOCs can be transported by groundwater movement at a rate governed by advection and chemical-specific retardation factors. Horizontal migration to the river represents the major migration pathway based on the absence of a non-aqueous phase for all of the VOCs detected, the generally low concentrations of VOCs (100 µg/L or less), and presence of upward hydraulic gradients.

TABLE 3
Natural Attenuation Indicator Parameters

Parameter	Favorable Criteria for Natural Attenuation	Measured Range	Frequency Meeting Criteria
Temperature (°C)	> 20°C	15.26–17.72	0/8
DO (mg/L)	<0.5	0.42–2.38	1/8
pH (SU)	5–9	5.03–7.81	8/8
ORP (mV)	<50	-169.2–125.4	6/8
Ferrous Iron (mg/L)	>1	0.2–2.6	7/8
Sulfide (mg/L)	>1	ND	0/8
Nitrite (mg/L)	presence	ND	0/8
Methane (µg/L)	>500	19–190	0/8
Chloride (mg/L)	> 2X background (20 mg/L)***	11.0–22.0	2/8
Alkalinity (mg/L)	> 2X background (20 mg/L)***	34–230	8/8
Sulfate (mg/L)	<20	<1.0–54	4/8
Nitrate (mg/L)	<1	ND	4/8
TOC (mg/L)	> 20	0.96-3.0	0/8
Ethene (µg/L)	>10	ND	0/8
Ethane (µg/L)	>10	ND	0/8

*Source: USEPA, 1998

*** Background concentration calculated from upgradient well IR49-MW05.
ND = Not Detected
SU = standard units
°C = degrees Celsius
mV = millivolts
mg/L = milligrams per liter
DO = dissolved oxygen
ORP = oxygen reduction potential
TOC = total organic compounds

Figures 5, **6**, and **7** depict concentration trends over time for TCE, 1,1,2,2-PCA, and VC respectively for groundwater collected from IR49-MW01. An exponential trend line was fitted to the curves and carried forward in time. The trend lines represent conservative degradation scenarios for each constituent to achieve their respective NCGWQS based on the historical data. Assuming that the degradation trends interpolated from groundwater data collected over the 17-month period continue, it is likely that the NCGWQS will be achieved in a relatively shorter time frame compared to the information provided in the RI/FS. Specifically, the time to achieve the NCGWQS is projected to be approximately 5 years compared to 30 years predicted in the RI/FS.

FIGURE 5
TCE Trend

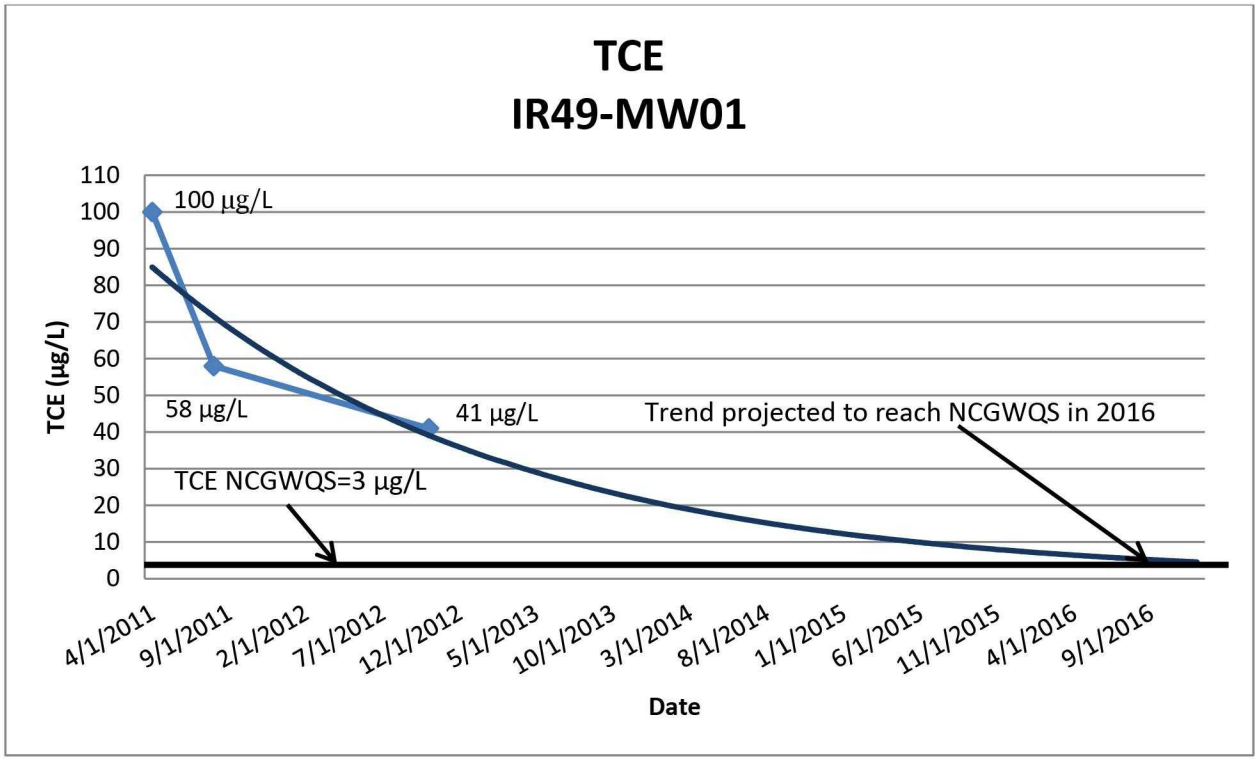


FIGURE 6
1,1,2,2-PCA Trend

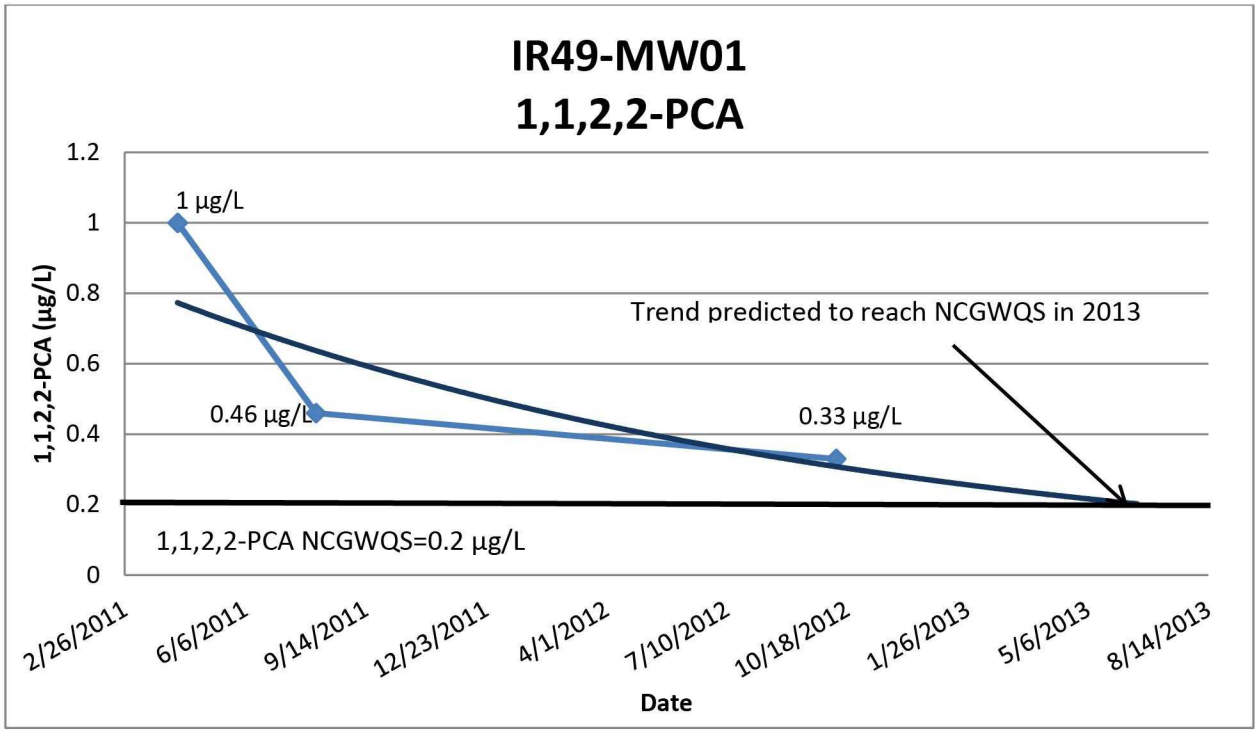
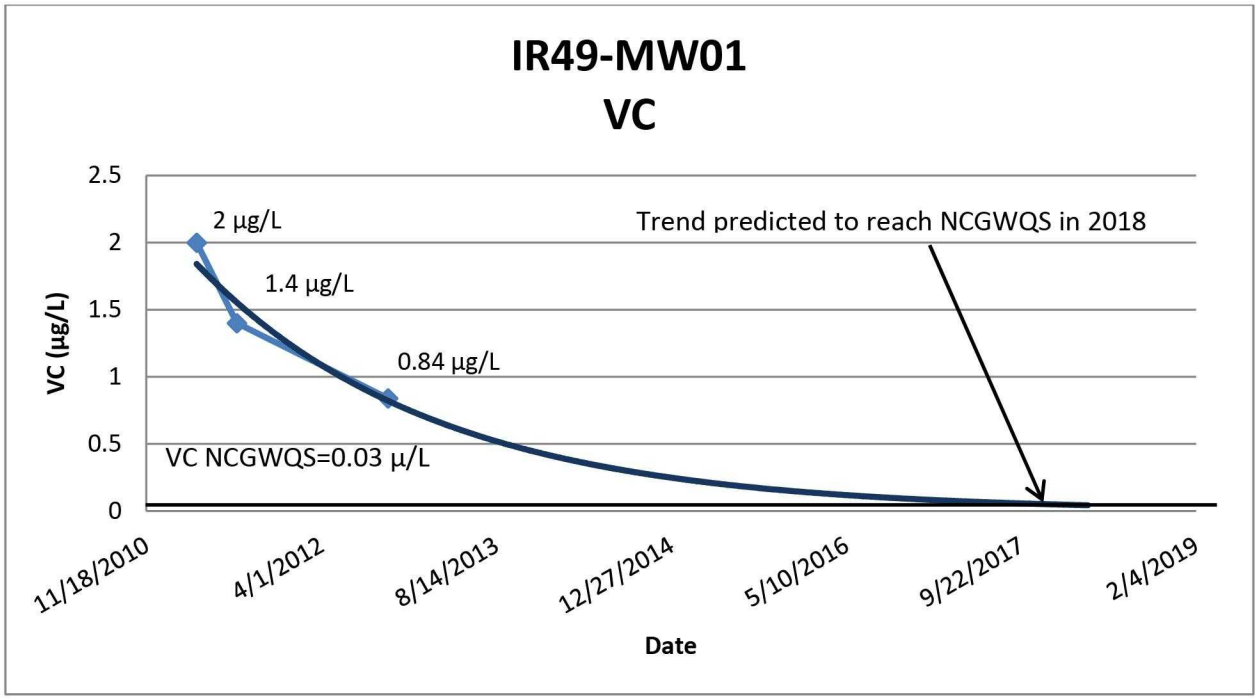


FIGURE 7
VC Trend



2.5 Current and Potential Future Land and Water Uses

A portion of the site (Building AS810) is currently used for storage, but the site is generally uninhabited. Potential current site users include site workers who occasionally access the site for landscaping activities or to access Building AS810, visitors, and trespassers. There are currently no plans for development of Site 49.

Potable water for MCIEAST-MCB CAMLEJ and the surrounding residential area is provided by public water supply wells that pump groundwater from the Castle Hayne aquifer. Regionally in southeastern North Carolina, the Castle Hayne aquifer may be used as a potable source of domestic water supply, watering lawns, or filling swimming pools. No active public water supply wells are located within a 1,500-foot radius of Site 49, and the site is not located within a designated wellhead protection area.

2.6 Summary of Site Risks

Potential human health and ecological risks at Site 49 were evaluated and documented during the 2012 RI/FS. Table 4 and the following subsections briefly summarize the findings of these risk assessments.

TABLE 4
Site 49 Risk Summary

Medium	Human Health Risk	Ecological Risk
Surface Soil	Acceptable	Acceptable
Subsurface Soil	Acceptable	Not Applicable*
Groundwater	Unacceptable	Not Applicable*
Pore Water	Acceptable	Acceptable
Sediment	Acceptable	Acceptable
Surface Water	Acceptable	Acceptable
Indoor Air	Unacceptable	Not Applicable*

*Ecological receptors are not exposed to subsurface soil, groundwater, or indoor air

2.6.1 Human Health Risk Summary

The human health risk assessment (HHRA) evaluated the potential impact resulting from exposure to soil, groundwater, pore water, sediment, surface water, and vapor intrusion at Site 49.

The **exposure scenarios** evaluated included: exposure to surface and subsurface soil for current site workers, trespassers, and visitors and future construction, industrial, and site workers, trespassers and visitors, and residents; exposure to surface water and sediment for current recreational users, site workers, and trespassers and visitors and future construction workers; exposure to groundwater for future industrial and construction workers and residents; and exposure to air (vapor intrusion) for future industrial workers and residents.

Health risks are based on a conservative estimate of the potential **cancer risk** or the potential to cause other health effects not related to cancer (non-cancer hazard, or **hazard index** [HI]). USEPA identifies an acceptable cancer risk range of 1 in 10,000 (10^{-4}) to 1 in 1,000,000 (10^{-6}) and an acceptable non-cancer hazard as an HI of less than 1. The estimates of risk at Site 49 were used to determine if any further actions were required to sufficiently protect human health. **Table 5 summarizes the potential human health risks identified. The HHRA concluded:**

- There is no unacceptable risk from exposure to surface soil, subsurface soil, pore water, sediment, or surface water.
- There is no unacceptable risk for industrial workers and construction workers from exposure to groundwater.

TABLE 5
HHRA Summary

Receptor	Media	Pathway	COC	Exposure Point Concentration* (µg/L for ingestion and dermal contact pathway, mg/m³ for inhalation pathway)	Reasonable Maximum Exposure (RME) Cancer Risk	RME Non-Cancer Hazard (HI)	Central Tendency Exposure (CTE) Cancer Risk	CTE Non-Cancer Hazard (HI)	Cancer Toxicity Factor (CSF) mg/kg-day-1	Inhalation Unit Risk Factor (IUR) (µg/m³)-1	Reference Dose (Rfd) mg/kg-day	Inhalation Reference Concentration (RfC) mg/m3
Future Adult Resident	Groundwater	Ingestion	1,1,2-2-PCA	7.9×10^{01}	NA	0.1	NA	0.006	NA	NA	2.0×10^{-02}	NA
			cis-1,2-DCE	1.2×10^{02}	NA	2	NA	0.2	NA	NA	2.0×10^{-03}	NA
		Dermal	cis-1,2-DCE	1.2×10^{02}	NA	0.1	NA	0.02	NA	NA	2.0×10^{-03}	NA
		Inhalation	1,1,2-TCA	2.5×10^{00}	NA	0.8	NA	0.04	NA	NA	NA	2.0×10^{-04}
			TCE	1.1×10^{02}	NA	0.9	NA	0.03	NA	NA	NA	1.0×10^{-02}
Future Child Resident	Groundwater	Ingestion	1,1,2,2-PCA	7.9×10^{01}	NA	0.3	NA	0.02	NA	NA	2.0×10^{-02}	NA
			cis-1,2-DCE	1.2×10^{02}	NA	4	NA	0.8	NA	NA	2.0×10^{-03}	NA
			trans-1,2-DCE	5.2×10^{01}	NA	0.2	NA	0.06	NA	NA	2.0×10^{-02}	NA
			VC	1.0×10^{01}	NA	0.2	NA	0.08	NA	NA	3.0×10^{-03}	NA
		Dermal	cis-1,2-DCE	1.2×10^{02}	NA	0.3	NA	0.04	NA	NA	2.0×10^{-03}	NA
		Inhalation	1,1,2-TCA	2.5×10^{00}	NA	1	NA	0.06	NA	NA	NA	2.0×10^{-04}
			trans-1,2-DCE	5.2×10^{01}	NA	0.1	NA	0.005	NA	NA	NA	6.0×10^{-02}
			TCE	1.1×10^{02}	NA	1	NA	0.05	NA	NA	NA	1.0×10^{-02}
Future Child/ Adult Resident	Groundwater	Ingestion	1,1,2,2-PCA	7.9×10^{01}	2.3×10^{-04}	NA	1.0×10^{-05}	NA	2.0×10^{-01}	NA	NA	NA
			1,1,2-TCA	2.5×10^{00}	2.1×10^{-06}	NA	4.0×10^{-07}	NA	5.7×10^{-02}	NA	NA	NA
			Benzene	1.3×10^{00}	1.0×10^{-06}	NA	2.4×10^{-07}	NA	5.5×10^{-02}	NA	NA	NA
			PCE	9.2×10^{-01}	7.4×10^{-06}	NA	1.9×10^{-06}	NA	5.4×10^{-01}	NA	NA	NA
			TCE	1.1×10^{02}	9.8×10^{-06}	NA	1.5×10^{-06}	NA	5.9×10^{-03}	NA	NA	NA
			VC	1.0×10^{01}	1.6×10^{-04}	NA	3.7×10^{-05}	NA	7.2×10^{-01}	NA	NA	NA
		Dermal Contact	1,1,2,2-PCA	7.9×10^{01}	2.9×10^{-05}	NA	8.8×10^{-07}	NA	2.0×10^{-01}	NA	NA	NA
			PCE	9.2×10^{-01}	4.4×10^{-06}	NA	7.9×10^{-07}	NA	5.4×10^{-01}	NA	NA	NA
			TCE	1.1×10^{02}	1.6×10^{-06}	NA	1.7×10^{-07}	NA	5.9×10^{-03}	NA	NA	NA
			VC	1.0×10^{01}	8.3×10^{-06}	NA	6.3×10^{-07}	NA	7.2×10^{-01}	NA	NA	NA
		Inhalation	1,1,2,2-PCA	7.9×10^{01}	9.9×10^{-05}	NA	5.7×10^{-07}	NA	NA	5.8×10^{-05}	NA	NA
			TCE	1.1×10^{02}	8.7×10^{-06}	NA	1.8×10^{-07}	NA	NA	2.0×10^{-06}	NA	NA
			VC	1.0×10^{01}	3.3×10^{-06}	NA	9.4×10^{-08}	NA	NA	4.4×10^{-06}	NA	NA

Notes:

Potential unacceptable risks or hazards with HIs above 1 and cancer risks above $1x10^{-04}$ are shaded yellow.

NA - Not Applicable

mg/m^3 – milligrams per cubic meter

$\mu g/m^3$ – micrograms per cubic meter

mg/kg-day – milligrams per kilograms per day

RME COCs included are based on individual constituents that contribute a non-cancer hazard >0.1 to a cumulative non-cancer HI >1 or a cancer risk $>10^{-6}$ to a cumulative cancer risk $>10^{-4}$.

- There is a potential risk to future residents from exposure to VOCs in groundwater associated with ingestion of 1,1,2,2-PCA, 1,1,2-TCA, 1,2-DCA, benzene, PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and VC if used as a potable water supply.
- While VOCs were detected in groundwater at concentrations above vapor intrusion groundwater screening levels (GWSLs) for an industrial building, there is no building within 100 feet of the impacted groundwater. Therefore, the vapor intrusion pathway is currently incomplete, but would need to be re-evaluated if future land uses changes.

2.6.2 Ecological Risk Summary

The ecological risk assessment (ERA) evaluated potential risks to ecological receptors. Risk was estimated by calculating hazard quotients (HQs) using the concentration of each contaminant in applicable media (soil, surface water, pore water, and sediment) and dividing by an ecological screening value (ESV). Contaminants were retained for further assessment if the HQ was greater than 1 (the concentration exceeded the ESV), the contaminant was detected but did not have an ESV, or the contaminant was not detected but the reporting limit was greater than the ESV. The list of COCs was further refined using a weight-of-evidence approach that considered spatial and temporal distribution of analytical results, the general ecological setting and health of the ecosystems, and food web modeling.

The results indicated that no constituents in site media are expected to cause a significant risk to populations of ecological receptors at Site 49 or in the adjacent New River.

2.6.3 Basis for Response Action

Based on the HHRA, exposure to groundwater at Site 49 poses an unacceptable risk to human health due to the presence of VOCs. In addition, under **North Carolina's groundwater classification**, the surficial aquifer is considered Class GA, a potential source of drinking water. NCDENR identified NCGWQS as a 'relevant and appropriate' requirement for groundwater remediation. As a result, chlorinated VOCs identified in groundwater at Site 49 at concentrations exceeding the NCGWQS (**Table 2**) are all considered COCs.

It is the current judgment of the Navy, USMC, and USEPA, in concurrence with NCDENR, that the Selected Remedy identified in this ROD, is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

The concentrations of COCs requiring a response action are summarized in **Table 2**, and the extent of groundwater impacts is shown on **Figure 3**.

2.7 Principal Threat Wastes

"Principal threat wastes" are source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should they be exposed. Contaminated groundwater generally is not considered to be a source material; however, non–aqueous phase liquids (NAPLs) in groundwater may be viewed as a source material. Dissolved concentrations of COCs in groundwater at approximately 1 percent, or greater, of a compound's solubility could suggest the presence of dense non-aqueous phase liquids (DNAPL) in the subsurface.

Since the maximum concentration of TCE (276 µg/L) detected in the surficial aquifer is 0.02 percent of the compound's solubility (1,280 milligrams per liter [mg/L] in water) and DNAPL was not observed during groundwater sampling activities, DNAPL is not likely present at the site.

2.8 Remedial Action Objectives

In order to be protective of human health and the environment and address potential future risks identified in the HHRA, the RAOs identified for Site 49 are as follows:

1 Restore groundwater quality to meet NCDENR and federal primary drinking water standards, based on the classification of the aquifer as a potential source of drinking water (Class GA or Class GSA) under 15A North Carolina Administrative Code (NCAC) 02L.0201.

2 Prevent exposure to COCs in groundwater and vapor intrusion from COCs in groundwater until such time as groundwater concentrations or vapor intrusion mitigation measures allow for UU/UE.

3 Minimize potential degradation of the New River by COC-affected groundwater.

Cleanup levels were developed for COCs contributing to unacceptable risks and hazards from exposure to groundwater at Site 49 (**Table 6**). The cleanup levels for the COCs listed are based upon chemical-specific applicable or relevant and appropriate requirements (ARARs) and are based on the more stringent of the NCGWQS or Safe Drinking Water Act Federal Maximum Contaminant Level (MCL).

TABLE 6
Groundwater Cleanup Levels

COC	NCGWQS/MCL* (µg/L)
1,1,2,2-PCA	0.2
1,1,2-TCA	5
1,2-DCA	0.4
Benzene	1
cis-1,2-DCE	70
PCE	0.7
TCE	3
trans-1,2-DCE	100
VC	0.03

µg/L - micrograms per liter
*NCGWQS or MCL, whichever is more conservative

2.9 Description and Comparative Analysis of Remedial Alternatives

2.9.1 Description of Remedial Alternatives

Remedial alternatives to address groundwater impacts at Site 49 were developed and are detailed in the 2012 RI/FS and the 2013 Technical Memorandum. Based on initial **screening of technologies**, four remedial alternatives to address groundwater impacts at Site 49 were developed and are summarized in **Table 7**. A detailed comparative analysis was conducted for each alternative.

TABLE 7
Remedial Alternatives

Alternative	Details	Cost	
1 - No Action	None	**Total Cost**	**$0**
		Timeframe	**Indefinite**
2 – MNA and LUCs	Biennial groundwater and pore water sampling to monitor the degradation of VOCs. LUCs to prohibit aquifer use and the potential for future vapor intrusion.	Capital cost	$13,000
		Biennial monitoring (yrs 1-5)	$43,000
		Total present value	**$56,000**
		Timeframe	**5 years**
3 – EISB, MNA, and LUCs	Injection of bioremediation substrate and bioaugmentation culture to reductively dechlorinate VOCs. Quarterly groundwater and pore water monitoring for the first year to evaluate effectiveness of injections followed by biennial monitoring. LUCs to prohibit aquifer use and the potential for future vapor intrusion.	Capital cost	$183,000
		Annual monitoring (yrs 1-2)	$20,000
		Reinjection after yr 1	$100,000
		Total present value	**$303,000**
		Timeframe	**2 years**
4 –AS, MNA, and LUCs	Injection of air to induce mass transfer (stripping) of VOCs from groundwater and/or aerobic biodegradation. Semi-annual groundwater and pore water monitoring for first two years to evaluate effectiveness followed by biennial monitoring. LUCs to prohibit aquifer use and the potential for future vapor intrusion.	Capital cost	$169,000
		Annual O&M (yrs 1-2)	$138,000
		Total present value	**$307,000**
		Timeframe	**2 years**

2.9.2 Comparative Analysis of Alternatives

A comparative analysis using the **nine USEPA criteria** was completed and is provided as follows. The analyses are summarized in **Table 8**.

TABLE 8
Comparative Analysis of Alternatives

CERCLA Criteria	No Action (1)	MNA and LUCs (2)	EISB, MNA, and LUCs (3)	AS, MNA, and LUCs (4)
Threshold Criteria				
Protection of human health and the environment	❍	●	●	●
Compliance with ARARs	❍	●	●	●
Primary Balancing Criteria				
Long-term effectiveness and permanence	❍	●	●	●
Reduction in toxicity, mobility, or volume through treatment	❍	❍	●	●
Short-term effectiveness	❍	◘	◘	❍
Implementability	●	●	❍	❍
Present-worth cost	$0	$56k	$303k	$307k
Modifying Criteria				
State acceptance	❍	●	●	●
Community acceptance	❍	●	●	●

Ranking: ● High ◘ Moderate ❍ Low

Threshold Criteria

Overall Protection of Human Health and the Environment

All of the alternatives screened, with the exception of the no action alternative, are protective of human health and the environment by reducing or controlling risks posed by the site through treatment, MNA, and/or LUCs. Alternatives 3 (EISB) and 4 (AS) provide active treatment and mass transfer to reduce the concentrations of COCs in groundwater, potentially expediting the NA process. Monitoring and LUCs will provide protection until RAOs are achieved for Alternatives 2, 3, and 4.

Compliance with ARARs

Section 121(d) of CERCLA, as amended, specifies in part, that remedial actions for cleanup of hazardous substances must comply with requirements and standards under federal or more stringent state environmental laws and regulations that are applicable or relevant and appropriate (i.e., ARARs) to the hazardous substances or particular circumstances at a site unless such ARAR(s) are waived under CERCLA Section 121(d) (4). *See also* 40 Code of Federal Regulations (CFR) § 300.430(f)(1)(ii)(B).

All alternatives, except the no action alternative, include MNA and LUCs and are expected to comply with **ARARs** presented in **Appendix A.** MNA and LUCs will be implemented to prevent exposure to groundwater until such time that the chemical-specific ARARs, including NCGWQS and Federal MCLs, can be achieved. Although the groundwater COCs were not detected in surface water and no unacceptable risks were identified from exposure to surface water, North Carolina Surface Water Quality Standards are listed as a chemical-specific ARAR based on the proximity to the New River and potential groundwater discharge. Additional action-specific and location-specific ARARs apply if Alternatives 3 and 4 are implemented regarding installation of underground injection wells, control of VOC emissions from groundwater treatment, and land-disturbing activities based on the presence of wetlands.

Primary Balancing Criteria

Long-term Effectiveness and Permanence

With the exception of the no action alternative, all alternatives are expected to be effective in the long-term. Alternatives 3 and 4 are expected to provide a greater degree of long-term effectiveness and permanence with the removal of VOCs in groundwater through treatment; however, contact with the contaminated media may be difficult in the clayey layers of the surficial aquifer. As a result, multiple injections or system restart may be required. Therefore, based on the decline in VOC concentrations to-date (see Section 2.4), Alternative 2 is expected to be as effective by physically reducing VOCs by NA, dilution, and adsorption.

Reduction of Toxicity, Mobility, or Volume through Treatment

Alternatives 3 and 4 would reduce toxicity, mobility, and volume through treatment. Although Alternative 2 does not actively provide treatment, MNA relies on the natural reduction of contaminant concentrations through a variety of physical, chemical, or biological activities over time.

Short-term Effectiveness

The period of time to implement the remedy and risks to the environment, workers, and the community would be lowest for Alternative 2 as no construction activities other than well abandonment, is involved with the implementation of the remedy. Alternative 2 has the lowest environmental footprint as no active treatment would be performed, only groundwater and pore water monitoring.

Alternative 3 would have slightly higher risks to workers and a longer period of time associated with remedy implementation because it involves the installation of injection wells and the injection of a bioremediation substrate. Although the period of time (2 years) to implement the air sparge system included in Alternative 4 is similar to Alternative 3, the risks to workers are generally higher due to increased labor required to perform operation and maintenance on the sparge system and the potential for air sparging to increase risks to Base workers from vapor intrusion into the adjacent building. Alternative 4 also has the highest greenhouse gas

emissions, energy use, water impacts, and criteria pollutant emissions because of the electricity used to power the AS system.

Implementability

Each alternative is implementable, with materials and services readily available. Alternative 2 is significantly easier to implement because only monitoring activities are required. Alternatives 3 and 4 will each require significant onsite implementation activities. EISB (Alternative 3) and AS (Alternative 4) both rely on a relatively uniform distribution of substrate or air. Clay lenses present in the subsurface at the site pose complications to achieve equal distribution throughout the contaminated groundwater as the air or substrate injected beneath the clay lenses would likely follow these layers until it reaches points where it is discontinuous and may daylight or circumvent contaminated groundwater resulting in incomplete treatment. Therefore, additional injections or sparging may be required to reach the cleanup levels.

Cost

Table 7 summarizes the capital costs, as well as long-term O&M costs (as applicable) for the alternatives. An order of magnitude cost for each alternative has been estimated based on a variety of key assumptions. The timeframes required to achieve the RAOs vary among alternatives. Significant uncertainty is associated with the timeframes.

Other than Alternative 1, the least expensive alternative was Alternative 2, with an estimated total present value of $56,000, followed by Alternative 3 with an estimated total present value of $303,000. Alternative 4 was the most expensive alternative, with a total present cost of $307,000. Alternative 2 also has the lowest total capital cost, estimated at $13,000. Alternatives 3 and 4 have estimated capital costs of $183,000 and $169,000, respectively.

Modifying Criteria

State Acceptance

State involvement has been solicited throughout the CERCLA process. NCDENR, as the designated state support agency in North Carolina, concurs with the Selected Remedy.

Community Acceptance

The public meeting was held on February 21, 2013 to present the Proposed Remedial Action Plan (PRAP) and answer community questions regarding the proposed remedial action at Site 49. The questions and concerns raised at the meeting were general inquiries for informational purposes only. No comments requiring amendment to the PRAP were received from the public during the meeting and public comment period.

2.10 Selected Remedy

The Selected Remedy for Site 49 is Alternative 2, MNA and LUCs, to prevent aquifer use and mitigate exposure to vapor intrusion.

2.10.1 Rationale for the Selected Remedy

The Selected Remedy (MNA and LUCs) is protective of human health and the environment, will be easier to implement, will degrade COCs in a reasonable timeframe, is a permanent remedial solution, and has lower associated costs. The primary rationale for selecting Alternative 2 in comparison with Alternatives 3 and 4 is based on the uncertainty of the injections to distribute substrate or air uniformly at acceptable quantities through the clayey layers of the surficial aquifer. Although conditions in the surficial aquifer are generally unfavorable for biological degradation for COCs based on suboptimal NA indicator parameters, analytical data collected from the site shows a decreasing trend in VOC concentrations over time. The decline in COC concentrations at monitoring well IR49-MW01 suggests that physical degradation of VOCs is the primary mechanism NA and includes dilution, dispersion, and sorption.

The ultimate goal is to restore groundwater quality to beneficial use. Based on information obtained during previous investigations and analysis of all remedial alternatives, MNA and LUCs will achieve this objective. Per

USEPA guidance, *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites*, clear and meaningful trends of decreasing contaminant mass have been documented, and hydrogeologic data demonstrate active NA processes at the site. Site-specific lines of evidence for MNA are presented in Section 2.4. LUCS will be implemented to prevent exposure to groundwater and potential vapor intrusion until the cleanup levels are achieved.

2.10.2 Description of the Selected Remedy

The Selected Remedy for Site 49 includes the following:

- MNA to monitor groundwater and pore water and track changes in COC concentrations and geochemical parameters
- LUCs to prevent aquifer use and protect any future potential receptors from vapor intrusion

MNA is planned to include biennial groundwater sampling from five existing monitoring wells and pore water sampling from two locations in the New River for analysis of 1,1,2,2-PCA, PCE, TCE, VC, benzene, 1,2-DCA, cis-1,2-DCE, trans-1,2-DCE, and 1,1,2-TCA until cleanup levels for groundwater have been met. Based on the distance of VOC-impacted groundwater (approximately 45 feet) from the New River and predicted contaminant migration values, VOCs in the surficial aquifer are expected reach cleanup levels in approximately 5 years. The specific details of sampling, frequency and the monitoring network will be presented in the Remedial Design (RD).

LUCs including, but not limited to, land use restrictions in the Base Master Plan, filing a Notice of Contaminated Site with the Register of Deeds of Onslow County, and administrative procedures to prohibit unauthorized activities (for example, excavation, well installation, or construction) will be implemented as part of the remedy to prevent exposure to the residual contamination on the site that exceeds the cleanup levels. Consideration of vapor intrusion is also required prior to any new construction or changes to existing building use or structure within the LUC boundary. The LUCs will be implemented and maintained by the Navy and MCIEAST-MCB CAMLEJ until the concentration of hazardous substances in the groundwater are at such levels to allow for UU/UE. The Navy and USMC are responsible for implementing, maintaining, reporting on, and enforcing LUCs. Although the Navy and MCIEAST – MCB CAMLEJ may later transfer these procedural responsibilities to another party by contract, property transfer agreement, or through other means, the Navy and MCIEAST – MCB CAMLEJ shall retain ultimate responsibility for the remedy integrity.

The LUC performance objectives include:

- To prohibit human consumption of groundwater from the surficial aquifer underlying Site 49
- To prohibit residential/recreational uses and development at the site including, but not limited to, any form of housing, any kind of school, child-care facilities, playgrounds, and adult nursing facilities
- To mitigate the potential for future vapor intrusion pathways
- To maintain the integrity of any existing or future monitoring system at the site such as monitoring wells.

The specific types of LUCs which will be implemented (to meet the objectives) include:

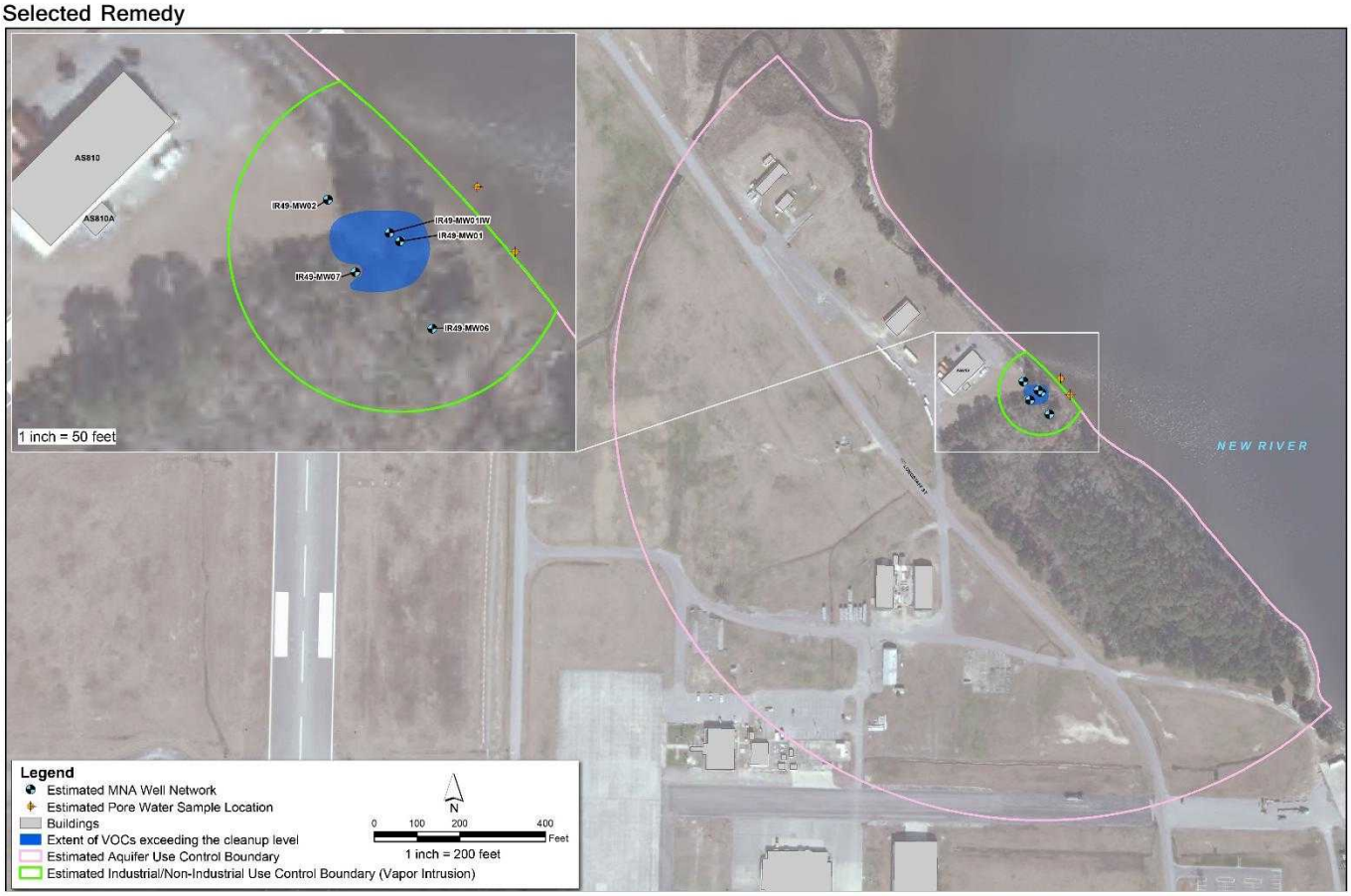
- Incorporating land and groundwater use prohibitions (Aquifer Use Control and Industrial/Non-Industrial Use Control) into the MCIEAST–MCB CAMLEJ Base Master Plan, including consideration of vapor intrusion for new construction or modification to existing structures within 100 feet of contaminated groundwater;
- Recording a Notice of Contaminated Site filed in Onslow County real property records in accordance with North Carolina General Statutes (NCGSs) 143B-279.9 and 143B-279.10;
- Maintaining the integrity of any current or future remedial or monitoring system, such as conducting site inspections to verify the integrity of the monitoring wells and to verify compliance with use restrictions; and,
- Filing deed and/or lease restrictions in the event of transfer for any portion of Site 49.

The estimated LUC boundary is provided on **Figure 8**, although the actual LUC boundaries will be finalized in the RD. The LUC implementation actions, including monitoring and enforcement requirements, will be provided in a Land Use Control Implementation Plan (LUCIP) that will be prepared as part of the RD.

The Navy will submit the LUCIP to USEPA and NCDENR for review and approval pursuant to the primary document review procedures stipulated in the FFA within 90 days of the ROD signature. The Navy will maintain, monitor (including conducting periodic inspections), and enforce the LUCs according to the requirements contained in the LUCIP and the ROD. The need for LUCs to prevent exposure and ensure protection will be periodically reassessed as COC concentrations are reduced over time.

Because COCs will remain at the site above levels that allow for UU/UE, the Navy will review the final remedial action no less than every 5 years to assess the protectiveness of the remedy.

FIGURE 8
Selected Remedy



2.10.3 Expected Outcomes of the Selected Remedy

Current land uses are expected to continue at Site 49. Cleanup levels for the Selected Remedy are based on UU/UE. Exposure will be controlled through LUCs until COCs in groundwater are reduced to the cleanup levels. **Table 9** summarizes the unacceptable risks, the RAOs identified to address the risks, the remedy components intended to achieve the RAOs, the metrics that measure the remedial action progress, and the expected outcome that the remedy will have.

TABLE 9
Expected Outcomes

Risk	RAO	Remedy Component	Metric	Expected Outcome
Future residential exposure to COCs in groundwater and indoor air	• Restore groundwater quality to meet NCDENR and federal primary drinking water standards, based on the classification of the aquifer as a potential source of drinking water [Class GA or Class GSA] under 15A NCAC 02L.0201. • Minimize potential degradation of the New River by COC-affected groundwater.	MNA	Implement until each groundwater COC is at or below its respective cleanup level for four consecutive monitoring events	Unlimited use and unrestricted exposure
	• Prevent exposure to COCs in groundwater and vapor intrusion from COCs in groundwater until such time as groundwater concentrations or vapor intrusion mitigation measures allow for unlimited use and unrestricted exposure.	LUCs	Maintain until each groundwater COC is at or below its respective cleanup level for four consecutive monitoring events	

2.10.4 Statutory Determinations

Remedial actions undertaken at NPL sites must meet the statutory requirements of Section 121 of CERCLA and thereby achieve adequate protection of human health and the environment, comply with ARARs of both federal and state laws and regulations, be cost-effective, and use, to the maximum extent practicable, permanent solutions and alternative treatment or resource recovery technologies. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, and/or mobility of hazardous waste as the principal element. The following discussion summarizes the statutory requirements that are met by the Selected Remedy.

Protection of Human Health and the Environment— The LUC components of the Selected Remedy will protect human health and the environment by preventing aquifer use and protecting any future potential receptors from vapor intrusion until the MNA restores the groundwater to meet drinking water standards (i.e., MCLs or NCGWQS).

Compliance with ARARs—Section 121(d) of CERCLA, as amended, specifies, in part, that remedial actions for cleanup of hazardous substances must comply with requirements and standards under federal or more stringent state environmental laws and regulations that are applicable or relevant and appropriate to the hazardous substances or particular circumstances at a site or obtain a waiver. See also 40 CFR § 300.430(f)(1)(ii)(B). ARARs include only federal and state environmental or facility citing laws and regulations and do not include occupational safety or worker protection requirements. Compliance with Occupational Safety and Health Administration (OSHA) standards is required by 40 CFR § 300.150, and therefore the CERCLA requirement for compliance with or wavier of ARARs does not apply to OSHA standards. In addition to ARARs, the lead and support agencies may, as appropriate, identify other advisories, criteria, or guidance to be considered for a particular release. In accordance with 40 CFR § 300.400(g), the Navy, USEPA, and NCDENR have identified the ARARs for the Selected Remedy. Appendix A lists, respectively, the chemical-, location-, and action-specific ARARs for the Selected Remedy. The Selected Remedy will meet all identified ARARs.

Cost-Effectiveness—The Selected Remedy is cost-effective and represents a reasonable value for the money to be spent. The following definition was used to determine cost-effectiveness: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness" (40 CFR §300.430[f][1][ii][D]). This analysis was accomplished by evaluating the overall effectiveness of those alternatives that satisfied the long-term effectiveness and

permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness. The overall effectiveness of the Selected Remedy was compared to costs to determine cost effectiveness. The Selected Remedy's costs were determined to be proportional to overall effectiveness, thus representing a reasonable value for the money.

The estimated present worth cost of the Selected Remedy is $56,000, and the remedial time frame is predicted be approximately 5 years. Although Alternatives 3 and 4 present worth costs are also reasonable, they are higher and will only shorten the remedial time frame by 3 years. This, coupled with the uncertainty of sufficient air or EISB substrate distribution due to the clay nature of the surficial aquifer, makes it difficult to conclude that Alternative 3 and Alternative 4 would represent reasonable values for the money.

Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable—Although the use of treatment technologies is typically preferred, the Navy, USMC, USEPA, and NCDENR determined that the MNA and LUCs provide the best balance of tradeoffs with respect to the balancing and modifying criteria.

Although the Selected Remedy is expected to require a longer period of time (5 years) to restore groundwater to UU/UE than Alternatives 3 and 4 (2 years) and does not include treatment, COCs in groundwater are isolated and expected to be reduced through physical NA processes for a reasonable present-worth cost ($79,000). LUCs will prevent exposure to COCs until cleanup levels have been reached and the State and community support the Selected Remedy.

Alternatives 3 and 4 are expected to reduce the toxicity, mobility, and volume of the COCs in groundwater through treatment; however, there is uncertainty with the distribution of air and EISB substrate through the clay in the surficial aquifer and re-injection of substrate or re-starting of the AS system may be required.

Preference for Treatment as a Principal Element— While the Selected Remedy does not satisfy the statutory preference for treatment as a principal element, MNA is expected to be successful in attaining the RAOs for groundwater based on contaminant trends over time. Additionally, no source materials constituting principal threats are present, the groundwater is not used for drinking water, and LUCs will prevent exposure until concentrations allow for UU/UE.

Five-Year Review Requirements— This remedy will result in hazardous substances, pollutants, or contaminants remaining on site above levels that allow for unlimited use and unrestricted exposure; therefore in accordance with CERCLA Section 121(c) and the NCP at 40 CFR 300.430 (f)(4)(ii) a statutory review will be conducted by the Navy within 5 years after initiation of remedial action to ensure that the remedy is, or will be, protective of human health and the environment. If the remedy is determined not to be protective of human health and the environment because, for example, LUCs have failed or treatment is unsuccessful, then additional remedial actions would be evaluated by the FFA parties and the Navy may be required to undertake additional remedial action.

2.11 Community Participation

The Navy, USMC, USEPA, and NCDENR provide information regarding the cleanup of MCIEAST-MCB CAMLEJ to the public through the community relations program, which includes a Restoration Advisory Board (RAB), public meetings, the Administrative Record file for the site, and announcements published in local newspapers. RAB meetings continue to be held to provide an information exchange among community members, the Navy, USMC, USEPA, and NCDENR. These meetings are open to the public and are held quarterly.

In accordance with Sections 113 and 117 of CERCLA, the Navy provided a public comment period for the Site 49 PRAP from February 17, 2013 through March 19, 2013 identifying MNA and LUCs as the preferred alternative. A public meeting to present the PRAP was held on February 21, 2013, at the Coastal Carolina Community College. Public notice of the meeting and availability of documents was placed in *The Globe*, *The Jacksonville Daily News*, and the *ROTOVUE* newspapers on February 17, February 14, and February 13, respectively.

The Administrative Record, Community Involvement Plan, and final technical reports concerning Site 49 can be obtained from the IRP web site: http://go.usa.gov/Dy5T. Internet access is available to the public at the following location:

Onslow County Public Library
58 Doris Avenue East
Jacksonville, North Carolina 28540
(910) 455-7350

2.12 Documentation of Significant Changes

The PRAP for Site 49 was released for public comment on February 17, 2013. No comments were submitted during the public comment period. No significant changes to the remedy, as originally identified in the PRAP, were necessary or appropriate.

3 Responsiveness Summary

The participants in the public meeting held on February 21, 2013, included representatives of the Navy, USMC, USEPA, and NCDENR. Several community members attended the meeting. Questions received during the public meeting were general inquiries and are described in the public meeting minutes in the Administrative Record. There were no comments received at the public meeting requiring amendment to the PRAP, and no additional written comments, concerns, or questions were received from community members during the public comment period.

Appendix A
ARARs

TABLE A-1
Chemical-Specific ARARs
Record of Decision
Operable Unit No. 23 (Site 49)
MCIEAST-MCB CAMLEJ, North Carolina

Media	Requirement	Prerequisite	Citation
Classification of contaminated groundwater	Groundwaters in the state naturally containing 250 mg/L or less chloride *are classified as GA (existing or potential source of drinking water supply for humans*) under 15A NCAC 02L .0201(1)	Groundwaters located within the boundaries or under the extraterritorial jurisdiction of the State of North Carolina - **Applicable**	15A NCAC 02L.0302(1)
	Groundwaters in the state naturally containing greater than 250 mg/L of chloride *are classified as GSA* under 15A NCAC 02L .0201(2)		15A NCAC 02L.0302(2)
Groundwater	Establishes maximum contaminant concentrations for groundwater. The following remedial goals have been set using these criteria. • 1,1,2,2 - PCA (0.2 µg/L) • PCE (0.7 µg/L) • TCE (3 µg/L) • Vinyl Chloride (0.03 µg/L) • Benzene (1 µg/L)	Class GA or GSA groundwaters with contaminant(s) concentrations exceeding standards listed in 15A NCAC 02L .0202 - **Applicable**	15A NCAC 02L.0202(a), (b), and (g)(9), (131), (132), (139), (145), and Appendix 1
	Shall not exceed the Safe Drinking Water Act National Revised Primary Drinking Water Regulations: maximum contaminant levels (MCLs) for organic contaminants specified in 40 CFR 141.61(a). • 1,1,2,-TCA (5 µg/L) • cis-1,2-DCE (70 µg/L) • trans-1,2,-DCE (100 µg/L)	Groundwaters classified as GA or GSA which are an existing or potential source of drinking water - **Relevant and Appropriate**	40 CFR 141.61(a)(9), (17), and (21)
Protection of adjacent surface water body	Toxic substances: shall not exceed the numerical quality standards (maximum permissible levels) to protect human health from carcinogens through consumption of fish (and shellfish) • Benzene (51 µg/l) • 1,1,2,2-PCA (4 µg/L) • PCE (3.3 µg/L) • TCE (30 µg/l) • Vinyl chloride (2.4 µg/l)	Tidal Salt Waters classified as Class SC (under 15A NCAC 02B.0220) with chemical concentrations exceeding 15A NCAC 02B Standards - **Relevant and Appropriate**	15A NCAC 02B.0208(a)(2)(B)
	Monitor and undertake management practices for sources of pollution such that water quality standards and best usage of receiving waters and all downstream waters will not be impaired.	Indirect discharges of waste or other source of water pollution into Tidal Salt Waters classified as Class SC - **Relevant and Appropriate**	15A NCAC 02B.0203

TABLE A-2
Action-Specific ARARs
Record of Decision
Operable Unit No. 23 (Site 49)
MCIEAST-MCB CAMLEJ, North Carolina

Action	Requirement	Prerequisite	Citation
Monitoring Well Installation, Operation, and Abandonment			
Implementation of groundwater monitoring system	Shall be constructed in a manner that will not result in contamination of adjacent groundwaters of a higher quality.	Installation of monitoring system to evaluate effects of any actions taken to restore groundwater quality, as well as the efficacy of treatment - **Applicable**	15A NCAC 02L.0110(b)
Construction of groundwater monitoring well(s)	No well shall be located, constructed, operated, or repaired in any manner that may adversely impact the quality of groundwater.	Installation of wells (including temporary wells, monitoring wells) other than for water supply - **Applicable**	15A NCAC 02C.0108(a)
	Shall be located, designed, constructed, operated and abandoned with materials and by methods which are compatible with the chemical and physical properties of the contaminants involved, specific site conditions, and specific subsurface conditions.		15A NCAC 02C.0108(c)
	Monitoring well and recovery well boreholes shall not penetrate to a depth greater than the depth to be monitored or the depth from which contaminants are to be recovered. Any portion of the borehole that extends to a depth greater than the depth to be monitored or the depth from which contaminants are to be recovered shall be grouted completely to prevent vertical migration of contaminants.		15A NCAC 02C.0108(d)
	Shall be constructed in such a manner as to preclude the vertical migration of contaminants with and along borehole channel.	Installation of wells (including temporary wells, monitoring wells) other than for water supply - **Applicable**	15A NCAC 02C.0108(f)
	The well shall be constructed in such a manner that water or contaminants from the land surface cannot migrate along the borehole annulus into any packing material or well screen area.		15A NCAC 02C.0108(g)

TABLE A-2
Action-Specific ARARs
Record of Decision
Operable Unit No. 23 (Site 49)
MCIEAST-MCB CAMLEJ, North Carolina

Action	Requirement	Prerequisite	Citation
Construction of groundwater monitoring well(s) (cont)	Packing material placed around the screen shall extend at least one foot above the top of the screen. Unless the depth of the screen necessitates a thinner seal, a one foot thick seal, comprised of chip or pellet bentonite or other material approved by the Department as equivalent, shall be emplaced directly above and in contact with the packing material.		15A NCAC 02C.0108(h)
	Grout shall be placed in the annular space between the outermost casing and the borehole wall from the land surface to the top of the bentonite seal above any well screen or to the bottom of the casing for open end wells. The grout shall comply with Paragraph (e) of Rule .0107 of this Section except that the upper three feet of grout shall be concrete or cement grout.		15A NCAC 02C.0108(i)
	All wells shall be grouted within seven days after the casing is set. If the well penetrates any water-bearing zone that contains contaminated or saline water, the well shall be grouted within one day after the casing is set.		15A NCAC 02C.0108(j)
	Shall be secured with a locking well cap to ensure against unauthorized access and use. Shall be equipped with a steel outer well casing or flush-mount cover, set in concrete, and other measures sufficient to protect the well from damage by normal site activities.		15A NCAC 02C.0108(k) and (l)
	The well casing shall be terminated no less than 12 inches above land surface unless all of the following conditions are met: (1) site-specific conditions directly related to business activities, such as vehicle traffic, would endanger the physical integrity of the well; and (2) the well head is completed in such a manner so as to preclude surficial contaminants from entering the well.		15A NCAC 02C.0108(n)

TABLE A-2
Action-Specific ARARs
Record of Decision
Operable Unit No. 23 (Site 49)
MCIEAST-MCB CAMLEJ, North Carolina

Action	Requirement	Prerequisite	Citation
Construction of groundwater monitoring well(s) (cont)	Shall have permanently affixed an identification plate. The identification plate shall be constructed of a durable, waterproof, rustproof metal or other material approved by the Department as equivalent and shall contain the following information: (1) well contractor name and certification number; (2) date well completed; (3) total depth of well; (4) a warning that the well is not for water supply and that the groundwater may contain hazardous materials; (5) depth(s) to the top(s) and bottom(s) of the screen(s); and (6) the well identification number or name assigned by the well owner.		15A NCAC 02C.0108(o)
	Shall be developed such that the level of turbidity or settleable solids does not preclude accurate chemical analyses of any fluid samples collected or adversely affect the operation of any pumps or pumping equipment.		15A NCAC 02C.0108(p)
	Shall be constructed in such a manner as to preclude the vertical migration of contaminants within and along the borehole channel.	Installation of temporary wells and all other non-water supply wells- **Applicable**	15A NCAC 02C.0108(s)
Maintenance of groundwater monitoring well(s)	Every well shall be maintained by the owner in a condition whereby it will conserve and protect groundwater resources, and whereby it will not be a source or channel of contamination or pollution to the water supply or any aquifer.	Installation of wells (including temporary wells and monitoring wells) other than for water supply **- Applicable**	15A NCAC 02C.0112(a)
	Broken, punctured, or otherwise defective or unserviceable casing, screens, fixtures, seals, or any part of the well head shall be repaired or replaced, or the well shall be abandoned pursuant to 15A NCAC 02C .0113		15A NCAC 02C.0112(d)
	All materials used in the maintenance, replacement, or repair of any well shall meet the requirements for new installation.		15A NCAC 02C.0112(c)

TABLE A-2
Action-Specific ARARs
Record of Decision
Operable Unit No. 23 (Site 49)
MCIEAST-MCB CAMLEJ, North Carolina

Action	Requirement	Prerequisite	Citation
Maintenance of groundwater monitoring well(s) (cont)	No well shall be repaired or altered such that the outer casing is completed less than 12 inches above land surface. Any grout excavated or removed as a result of the well repair shall be replaced in accordance with Rule .0107(f) of this Section.		15A NCAC 02C.0112(f)
Abandonment of groundwater monitoring well(s)	Shall be abandoned by filling the entire well up to land surface with grout, dry clay, or material excavated during drilling of the well and then compacted in place; and	Permanent abandonment of wells (including temporary wells, monitoring wells, and test borings) other than for water supply less than 20 feet in depth and which do not penetrate the water table - **Applicable**	15A NCAC 02C.0113(d)(1)
	Shall be abandoned by completely filling with a bentonite or cement - type grout.	Permanent abandonment of wells (including temporary wells, monitoring wells, and test borings) other than for water supply greater than 20 feet in depth and which do not penetrate the water table - **Applicable**	15A NCAC 02C.0113(d)(2)
	All wells shall be permanently abandoned in which the casing has not been installed or from which the casing has been removed, prior to removing drilling equipment from the site.	Permanent abandonment of wells (including temporary wells) other than for water supply – **Applicable**	15A NCAC 02C.0113(f)

TABLE A-2
Action-Specific ARARs
Record of Decision
Operable Unit No. 23 (Site 49)
MCIEAST-MCB CAMLEJ, North Carolina

Action	Requirement	Prerequisite	Citation
Waste Characterization, Storage, and Disposal — Primary Wastes (i.e., well soil cuttings and purge water) and Secondary Wastes (e.g., PPE and used equipment)			
Characterization of solid waste (e.g., well soil cuttings)	Must determine if solid waste is hazardous waste or if waste is excluded under 40 CFR 261.4(b); and Must determine if waste is listed under 40 CFR Part 261; or	Generation of solid waste as defined in 40 CFR 261.2 and which is not excluded under 40 CFR 261.4(a) – **Applicable**	15A NCAC 13A.0107 only as it incorporates 40 CFR 262.11(a) and (b)
	Must characterize waste by using prescribed testing methods or applying generator knowledge based on information regarding material or processes used.		15A NCAC 13A.0107 only as it incorporates 40 CFR 262.11(c)
Storage of solid waste	All solid waste shall be stored in such a manner as to prevent the creation of a nuisance, insanitary conditions, or a potential public health hazard.	Generation of solid waste which is determined not to be hazardous – **Relevant and Appropriate**	15A NCAC 13B.0104(f)
	Containers for the storage of solid waste shall be maintained in such a manner as to prevent the creation of a nuisance or insanitary conditions.		15A NCAC 13B.0104(e)
	Containers that are broken or that otherwise fail to meet this Rule shall be replaced with acceptable containers.		

TABLE A-2
Action-Specific ARARs
Record of Decision
Operable Unit No. 23 (Site 49)
MCIEAST-MCB CAMLEJ, North Carolina

Action	Requirement	Prerequisite	Citation
Disposal of solid waste	Shall ensure that waste is disposed of at a site or facility which is permitted to receive the waste.	Generation of solid waste intended for off-site disposal – **Offsite Requirement**	15A NCAC 13B.0106(b)
Transportation of Wastes			
Transportation of hazardous materials	Shall be subject to and must comply with all applicable provisions of the HMTA and DOT HMR at 49 CFR 171-180.	Any person who, under contract with a department or agency of the federal government, transports "in commerce," or causes to be transported or shipped, a hazardous material – **Offsite Requirement**	49 CFR 171.1(c)
Transportation of samples	Are not subject to any requirements of 40 CFR Parts 261 through 268 or 270 when: • the sample is being transported to a laboratory for the purpose of testing; or • the sample is being transported back to the sample collector after testing. • the sample is being stored by sample collector before transport to a lab for testing	Samples of solid waste or a sample of water, soil for purpose of conducting testing to determine its characteristics or composition – **Offsite Requirement**	15A NCAC 13A.0106 only as it incorporates 40 CFR 261.4(d)(1)(i)-(iii)
	In order to qualify for the exemption in paragraphs (d)(1)(i) and (ii), a sample collector shipping samples to a laboratory must: • Comply with U.S. DOT, U.S. Postal Service, or any other applicable shipping requirements • Assure that the information provided in (1) thru (5) of this section accompanies the sample. Package the sample so that it does not leak, spill, or vaporize from its packaging.		15A NCAC 13A.0106 only as it incorporates 40 CFR 261.4(d)(2)(i)(A) and (B)
Institutional Controls for Contamination Left in Place			

TABLE A-2
Action-Specific ARARs
Record of Decision
Operable Unit No. 23 (Site 49)
MCIEAST-MCB CAMLEJ, North Carolina

Action	Requirement	Prerequisite	Citation
Notice of Contaminated Site	Prepare and certify by professional land surveyor a survey plat which identifies contaminated areas which shall be entitled "NOTICE OF CONTAMINATED SITE".	Contaminated site subject to current or future use restrictions included in a remedial action plan as provided in G.S. 143B-279.9(a) - **To-Be-Considered**	NCGS 143B-279.10(a)
Notice of Contaminated Site (cont)	Notice shall include a legal description of the site that would be sufficient as a description in an instrument of conveyance and meet the requirements of NCGS 47-30 for maps and plans.		
	The survey plat shall identify: • the location and dimensions of any disposal areas and areas of potential environmental concern with respect to permanently surveyed benchmarks; • the type location, and quantity of contamination known to exist on the site; and • any use restriction on the current or future use of the site.		NCGS 143B-279.10(a)(1)-(3)
	The deed or other instrument of transfer shall contain in the description section, in no smaller type than used in the body of the deed or instrument, a statement that the property is a contaminated site and reference by book and page to the recordation of the Notice.	Contaminated site subject to current or future use restrictions as provided in G.S. 143B-279.9(a) that is to sold, leased, conveyed or transferred - **To-Be-Considered**	NCGS 143B-279.10(e)

TABLE A-3
Location-Specific ARARs
Record of Decision
Operable Unit No. 23 (Site 49)
MCIEAST-MCB CAMLEJ, North Carolina

Location	Requirement	Prerequisite	Citation
Presence of migratory birds listed in 50 CFR 10.13	No person may take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such bird except as may be permitted under the terms of a valid permit issued pursuant to the provisions of this part and part 13 of this chapter, or as permitted by regulations in this part, or part 20 of this subchapter (the hunting regulations).	Action that have potential impacts on, or is likely to result in a 'take' (as defined in 50 CFR 10.12) of migratory birds – **Applicable**	Migratory Bird Treaty Act, 16 U.S.C. §703(a) 50 CFR 21.11
Coastal zone as defined in 16 U.S.C.§1453	Federal agency shall determine which of their activities affect any coastal use or resource of States with approved management programs. If agency determines activity has no effects on coastal use or resource, and a negative determination under § 930.35 is not required, then coordination with State Agencies under Section 307 of the Act is not required. The State agency and federal agencies may agree to exclude environmentally beneficial agency activities (either on a case-by-case basis or for a category of activities) from further State agency consistency review. NOTE: Consultation is generally considered an 'administrative' requirement and therefore under CERCLA 121(e)(1) a federal agency is not required to perform. However, such consultation is strongly recommended considering under 50 CFR 930.34 Federal agencies shall provide State(s) with a consistency determination.	Federal agency activity that may have effect on any coastal use or resource as defined in 15 CFR 930.11– **Applicable**	15 CFR 930.33(a)(1), (a)(2), (a)(4), (b)

Appendix B
Acronyms and Abbreviations

Acronyms and Abbreviations

µg/L	microgram per liter
ARAR	applicable or relevant and appropriate requirement
AS	air sparging
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
COC	chemical of concern
CSF	cancer slope factor
CSM	conceptual site model
CTO	central tendency exposure
DCA	dichloroethane
DCE	dichloroethene
DNAPL	dense non-aqueous phase liquid
EISB	enhanced in situ bioremediation
ERA	ecological risk assessment
ESV	ecological screening value
FFA	Federal Facilities Agreement
FS	Feasibility Study
GWSL	groundwater screening level
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
IAS	Initial Assessment Study
ID	Identification
IRP	Installation Restoration Program
IUR	Inhalation Unit Risk
LUC	land use control
LUCIP	Land Use Control Implementation Plan
MCAS	Marine Corps Air Station
MCIEAST-MCB CAMLEJ	Marine Corps Installations East-Marine Corps Base Camp Lejeune
MCL	Maximum Contaminant Level
mg/kg-day	milligram per kilogram per day
mg/L	milligram per liter
MNA	monitored natural attenuation
msl	mean sea level
NA	natural attenuation
NAPL	non-aqueous phase liquid
Navy	United States Department of the Navy
NCAC	North Carolina Administrative Code
NCDENR	North Carolina Department of Environment and Natural Resources
NCGS	North Carolina General Statutes
NCGWQS	North Carolina Groundwater Quality Standards
NCSWQS	North Carolina Surface Water Quality Standards

NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	no further action
NPL	National Priorities List
O&M	operations and maintenance
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PA	Preliminary Assessment
PCA	tetrachloroethane
PCE	tetrachloroethene
PRAP	Proposed Remedial Action Plan
RAB	Restoration Advisory Board
RAO	Remedial Action Objective
RD	Remedial Design
RfC	reference concentration
RfD	reference dose
RI	Remedial Investigation
RME	reasonable maximum exposure
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act of 1986
SI	Site Investigation
SVOC	semivolatile organic compound
TCA	trichloroethane
TCE	trichloroethene
USEPA	United States Environmental Protection Agency
USMC	United States Marine Corps
UU/UE	unlimited use and unrestricted exposure
VC	vinyl chloride
VOC	volatile organic compound

Appendix C
NCDENR Concurrence Letter

NCDENR
North Carolina Department of Environment and Natural Resources
Division of Waste Management
Dexter R. Matthews
Director

Pat McCrory
Governor

John E. Skvarla, III
Secretary

January 06, 2014

NAVFAC Mid-Atlantic
Attn: Dave Cleland Code: OPQE
USMC NC IPT, EV Business Line
6506 Hampton Blvd
Norfolk, VA 23508

RE: Concurrence with the 2013 Final Record of Decision (ROD) for OU #23, Site 49
Soil and Groundwater
MCB Camp Lejeune, NC
NC6170022580
Jacksonville, Onslow County, North Carolina

Dear Mr. Cleland:

The NC Superfund Section has received and reviewed the Final Record of Decision (ROD) for Ou#23, Site 49 at MCB, Camp Lejeune dated December 2013 and concurs that the selected remedy is protective of human health and the environment.

The State's concurrence is based solely on the information contained in the Final ROD dated December 2013 for Operable Unit #23 Site 49. Should we receive additional information that significantly affects the conclusions of the ROD, we may modify or withdraw this concurrence with written notice to the Naval Facilities Engineering Command for Camp Lejeune and the EPA Region IV.

If you have any questions or comments, please contact Randy McElveen, at (919) 707-8341 or email randy.mcelveen@ncdenr.gov

Sincerely,

Dexter Matthews
Director, Division of Waste Management

Cc: David Lown, Head, PE, PG, Federal Remediation Branch
Charity Rychak, EMD/IR
Gena Townsend, USEPA

References

Reference Number	Reference Phrase in ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record
1	chlorinated volatile organic compounds	Table 1	CH2M HILL. 2011. *Final Preliminary Assessment/Site Inspection Report, Site 49, Marine Corps Air Station, Suspected Minor Dump. Marine Corps Base Camp Lejeune, Jacksonville, North Carolina.* March. Section 4 and Appendix B
2	MCAS Suspected Minor Dump	Table 1	Water and Air Research, Inc. (WAR). 1983. *Initial Assessment Study of Marine Corps Base, Camp Lejeune. North Carolina*. Prepared for Naval Energy and Environmental Support Activity.
3	potential human health and ecological risks	Table 1	CH2M HILL. 2011. *Final Preliminary Assessment/Site Inspection Report, Site 49, Marine Corps Air Station, Suspected Minor Dump. Marine Corps Base Camp Lejeune, Jacksonville, North Carolina.* March. Section 4.4, and 4.5 and Appendix C and D.
4	nature and extent of contamination	Table 1	CH2M HILL. 2012. *Remedial Investigation/Feasibility Study Operable Unit No. 23, Site 49 – Suspected Minor Dump Site. Marine Corps Installation East – Marine Corps Base Camp Lejeune, Jacksonville, North Carolina.* July. Section 4.
5	remedial alternatives	Table 1	CH2M HILL. 2012. *Remedial Investigation/Feasibility Study Operable Unit No. 23, Site 49 – Suspected Minor Dump Site. Marine Corps Installation East – Marine Corps Base Camp Lejeune, Jacksonville, North Carolina.* July. Section 9 and 10.
6	exposure scenarios	Section 2.6.1	CH2M HILL. 2012. *Remedial Investigation/Feasibility Study Operable Unit No. 23, Site 49 – Suspected Minor Dump Site. Marine Corps Installation East – Marine Corps Base Camp Lejeune, Jacksonville, North Carolina.* July. Section 6.3.2.
7	cancer risk	Section 2.6.1	CH2M HILL. 2012. *Remedial Investigation/Feasibility Study Operable Unit No. 23, Site 49 – Suspected Minor Dump Site. Marine Corps Installation East – Marine Corps Base Camp Lejeune, Jacksonville, North Carolina.* July. Section 6.5.
8	hazard index	Section 2.6.1	CH2M HILL. 2012. *Remedial Investigation/Feasibility Study Operable Unit No. 23, Site 49 – Suspected Minor Dump Site. Marine Corps Installation East – Marine Corps Base Camp Lejeune, Jacksonville, North Carolina.* July. Section 6.5.

REFERENCES

Reference Number	Reference Phrase in ROD	Location in ROD	Identification of Referenced Document Available in the Administrative Record
9	North Carolina's groundwater classification	Section 2.6.3	North Carolina Administrative Code, Title 15A, Department of Environment, Health and Natural Resources, Subchapter 2L – Groundwater Classification and Standards. Section 200, Rule .0202. NCDENR, January 2010.
10	screening of technologies	Section 2.9.1	CH2M HILL. 2012. *Remedial Investigation/Feasibility Study Operable Unit No. 23, Site 49 – Suspected Minor Dump Site. Marine Corps Installation East – Marine Corps Base Camp Lejeune, Jacksonville, North Carolina.* July. Section 9.
11	nine USEPA criteria	Section 2.9.2	CH2M HILL. 2012. *Remedial Investigation/Feasibility Study Operable Unit No. 23, Site 49 – Suspected Minor Dump Site. Marine Corps Installation East – Marine Corps Base Camp Lejeune, Jacksonville, North Carolina.* July. Section 10.
12	ARARs	Section 2.9.2	CH2M HILL. 2012. *Remedial Investigation/Feasibility Study Operable Unit No. 23, Site 49 – Suspected Minor Dump Site. Marine Corps Installation East – Marine Corps Base Camp Lejeune, Jacksonville, North Carolina.* July. Section 8.3.